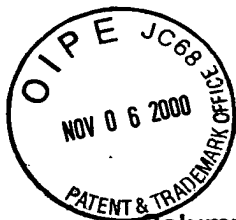
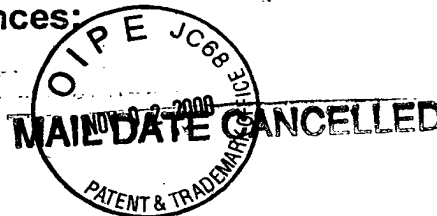


Translation of the explanations ("Erklärungen") of enclosure 2  
 ("Anlage 2") of the search report of the German Patent Office  
 ("Deutsches Patentamt") explaining the symbol letters stating the  
 relevancy of the cited references:



**Explanations**



**Column 1:**

**Category**

It means:

- X:** References which alone question either novelty or inventiveness
- Y:** References which question inventiveness together with other references
- A:** State of the art in general, technological background
- O:** Non-written disclosure, e.g. lecture being published in a reference dated later than the filing date or priority date, and having been held before the filing or priority date
- P:** References published prior to the filing date but later than the priority date claimed
- T:** References published after the filing date or priority date, and not being in conflict with the application, which concern the theory of the invention and which are cited to better understand the invention or to prove that the principle or theory underlying the invention could be wrong
- E:** Prior applications according to § 3 par. 2 PatG (German Patent Statute) (for searches according to § 43 PatG); prior patent applications or prior utility models according to § 15 GbmG (German Utility Model Statute) (for searches according to § 7 GbmG)
- D:** References already cited in the patent application
- L:** References cited for special reasons, e.g. to establish the publication date of another citation or if there exist doubts on priority claim(s)

In searches according to § 7 GbmG only categories "A" and "E" are indicated.

**Column 2:**

**Cited references / illustrations**

**Veröff:** Date of publication of a reference published in the priority period

**nr:** Not searched, since belonging to well known state of the art, or not searchable

**=:** References which are member of the same patent family or which are referenced by lectures or abstracts

**"-":** Nothing ascertained

**Column 3:**

**Concerned claims**

In this column, the claims allocated to the relevant passages of column 2 are indicated.

# Deutsches Patent- und Markenamt

München, den 26. Juni 2000

Telefon: (0 89) 21 95 - 3204

Aktenzeichen: 199 40 630.8

Anmelder:  
Asea Brown Boveri AG

Deutsches Patent- und Markenamt · 80297 München

Patentanwalt  
Dipl.-Ing.Dr.rer.nat.  
Gert Lück  
Langenweg 11

79761 Waldshut-Tiengen

Ihr Zeichen: 99/190 DE

Bitte Aktenzeichen und Anmelder bei  
allen Eingaben und Zahlungen angeben

Zutreffendes ist angekreuzt ☒ und/oder aus ausgefüllt!

## Ergebnis einer Druckschriftenermittlung

Auf den Antrag des

wirksam am 27. August 1999 gemäß ☒ § 43 Patentgesetz ☐ § 7 Gebrauchsmustergesetz  
sind die auf den beigefügten Anlagen angegebenen öffentlichen Druckschriften ermittelt worden.  
Ermittelt wurde in folgenden Patentklassen:

| Klasse/Gruppe   | Prüfer    | Patentabt. |
|-----------------|-----------|------------|
| H02K 5/26, 1/18 | Niestrath | 32         |

Die Recherche im Deutschen Patent- und Markenamt stützt sich auf die Patentliteratur folgender Länder und Organisationen:

Deutschland (DE,DD), Österreich, Schweiz, Frankreich, Großbritannien, USA, Japan (Abstracts),  
UDSSR (Abstracts), Europäisches Patentamt, WIPO.

Recherchiert wurde außerdem in folgenden Datenbanken:

Anlagen: 3-fach

Anlagen 1, 2 und 3 zur Mitteilung der ermittelten Druckschriften

Patentabteilung 11  
Recherchen-Leitstelle

3 Druckschrift(en) bzw. Ablichtung(en)



P 2251  
05/99  
06.95

Annahmestelle und  
Nachbriefkasten  
nur  
Zweibrückenstraße 12

Dienstgebäude  
Zweibrückenstraße 12 (Hauptgebäude)  
Zweibrückenstraße 5-7 (Breiterhof)  
Cincinnatistraße 64  
Rosenheimer Straße 116  
Balanstraße 59

Hausadresse (für Fracht)  
Deutsches Patent- und Markenamt  
Zweibrückenstraße 12  
80331 München

Telefon (089) 2195-0  
Telefax (089) 2195-2221

Bank: Landeszentralbank München 700 010 54  
(BLZ 700 000 00)

Internet-Adresse <http://www.patent-und-markenamt.de>



Schnellbahnanschluß im  
Münchner Verkehrs- und  
Tarifverbund (MVV):

Zweibrückenstraße 12 (Hauptgebäude),  
Zweibrückenstraße 5-7 (Breiterhof);  
S1 - S8 Isartor

Rosenheimer Str. 116 / Balanstraße 59  
Alle S-Bahnen Richtung Ostbahnhof, ab Ostbahnhof Buslinien  
45 / 95 / 96 / 198 Haltestelle Kustermannpark

Cincinnatistraße 64  
S2 Fasangarten Bus 98 oder 99

**Deutsches Patent- und Markenamt**

80297 München

**Anlage 2**

zur Mitteilung der ermittelten Druckschriften

Aktenzeichen

199 40 630.8

**Erläuterungen zu den ermittelten Druckschriften:**

| 1              | 2                                       |              |               | 3                    |
|----------------|---|--------------|---------------|----------------------|
| Kate-<br>gorie | Ermittelte Druckschriften/Erläuterungen |              |               | Betrifft<br>Anspruch |
| D,A            | EP                                      | 06 33 643 A2 | Fig.          | 1                    |
| D,A            | US                                      | 46 63 553    | Fig.          | 1                    |
| A              | DE-OS                                   | 15 13 765    | Anspr.1, Fig. | 1,3,4                |

**Hinweise zur Mitteilung (Vordruck P 2251)**

Eine Gewähr für die Vollständigkeit der Ermittlung wird nicht geleistet (§ 43 Abs. 7 Patentgesetz bzw. § 7 Abs. 2 Gebrauchsmustergesetz i.V.m. § 43 Abs. 7 Satz 1 Patentgesetz).

Die angegebene Patentliteratur kann in den Auslegehallen des Deutschen Patent- und Markenamts, 80331 München, Zweibrückenstraße 12, oder 10969 Berlin, Gitschiner Str. 97 eingesehen werden; deutsche Patentschriften, Auslegeschriften und Offenlegungsschriften auch in den Patentinformationszentren. Ein Verzeichnis über diese Patentinformationszentren kann auf Wunsch vom Deutschen Patent- und Markenamt sowie von einigen Privatfirmen bezogen werden.

**Erklärungen zur Anlage 2 (Vordruck P 2253)****Spalte 1: Kategorie**

Es bedeutet:

- X: Druckschriften, die Neuheit oder Erfindungshöhe allein in Frage stellen
- Y: Druckschriften, die die Erfindungshöhe zusammen mit anderen Druckschriften in Frage stellen
- A: Allgemein zum Stand der Technik, technologischer Hintergrund
- O: Nicht-schriftliche Offenbarung, z.B. ein in einer nachveröffentlichten Druckschrift abgedruckter Vortrag, der vor dem Anmelde- oder Prioritätstag öffentlich gehalten wurde
- P: Im Prioritätsintervall veröffentlichte Druckschriften
- T: Nachveröffentlichte, nicht kollidierende Druckschriften, die die Theorie der angemeldeten Erfindung betreffen und für ein besseres Verständnis der angemeldeten Erfindung nützlich sein können bzw. zeigen, daß der angemeldeten Erfindung zugrunde liegende Gedankengänge oder Sachverhalte falsch sein könnten
- E: Ältere Anmeldungen gemäß § 3 Abs. 2 PatG (bei Recherchen nach § 43 PatG); ältere Patentanmeldungen oder ältere Gebrauchsmuster gemäß § 15 GbmG (bei Recherchen nach § 7 GbmG)
- D: Druckschriften, die bereits in der Patentanmeldung genannt sind
- L: Aus besonderen Gründen genannte Druckschriften, z.B. zum Veröffentlichungstag einer Entgegnung oder bei Zweifeln an der Priorität.

**Spalte 2: Ermittelte Druckschriften / Erläuterungen**

**Veröff.:** Veröffentlichungstag einer Druckschrift im Prioritätsintervall

**nr:** Nicht recherchiert, da allgemein bekannter Stand der Technik, oder nicht recherchierbar

**=:** Druckschriften, die auf dieselbe Ursprungsanmeldung zurückgehen ("Patentfamilien") oder auf die sich Referate oder Abstracts beziehen.

**"-":** Nichts ermittelt

**Spalte 3: Betroffene Ansprüche**

Hier sind die Ansprüche unter Zuordnung zu den in Spalte 2 genannten relevanten Stellen angegeben.

199 40 630.8

Deutsches Patent- und Markenamt - 80297 München

Anlage 1

zur Mitteilung über die ermittelten Druckschriften  
gemäß § 43 des Patentgesetzes

Druckschriften:


DE-OS 15 13 765  
EP 06 39 643 A2

US 46 63 553

Dear Sirs,

99/190 DE

Please note that the Nr. EP 06 39 643 A2, as of Deutsches Patent- und Markenamt mentioned on this page, is not correct. The correct reference is EP 06 33 643 A 2, see Anlage 2 of the same document, which has been mentioned in the Application text several times.

With best regards  
Mirjana Zoric   
on behalf of Mr. Rainer Liebe  
Intellectual property (SLE-I)  
Baden, 15. Aug. 2000

# Zahlungshinweise

1. Die **Gebühren** können außer durch Barzahlung entrichtet werden:
  - a) durch Übergabe oder Übersendung
    - von Gebührenmarken des Deutschen Patent- und Markenamts,
    - von Schecks, die auf ein Kreditinstitut in der Bundesrepublik Deutschland gezogen sind und nicht mit Indossament versehen sind,
    - eines Auftrags zur Abbuchung von dem hierfür zugelassenen Abbuchungskonto gemäß Bekanntmachung des Präsidenten des Deutschen Patent- und Markenamts (siehe Mitteilungen Nr. 1 und 2/90 vom 15. Dezember 1989, Bl.f.PMZ 1990, S. 1 f.; Nr. 6/92 vom 27. Februar 1992, Bl.f.PMZ 1992, S. 177 f.),
  - b) durch Überweisung auf das umseitig angegebene Konto der Zahlstelle,
  - c) durch Bareinzahlung (mit Zahlschein bei der Postbank oder bei allen anderen Banken oder Sparkassen) auf das umseitig angegebene Konto der Zahlstelle.
2. Bei jeder Zahlung sind das vollständige **Aktenzeichen** und der Verwendungszweck in Form des **Gebührencodes**, der sich aus den Gebührenverzeichnissen aus der Anlage zu § 1 PatGebG oder aus der Anlage zu § 2 Abs. 1 DPMAVwKostV ergibt, anzugeben (Auszug s.u.<sup>1)</sup>).  
Unkorrekte bzw. unvollständige Angaben führen zu Verzögerungen in der Bearbeitung.
3. Als **Einzahlungstag** gilt gemäß § 3 der Verordnung über die Zahlung der Gebühren des Deutschen Patent- und Markenamts und des Bundespatentgerichts
  - a) bei Übergabe oder Übersendung von Gebührenmarken der Tag des Eingangs;
  - b) bei Übergabe oder Übersendung von Schecks oder Abbuchungsaufträgen der Tag des Eingangs beim Deutschen Patent- und Markenamt oder Bundespatentgericht, sofern die Einlösung bei Vorlage erfolgt (da Abbuchungsaufträge auch per Telekopie wirksam übermittelt werden können, ist es mit dieser Zahlungsart möglich, entsprechende Zahlungen noch bis 24.00 Uhr des letzten Tages der Frist vorzunehmen);
  - c) bei Bareinzahlung mit Zahlschein bei der Postbank und allen anderen Banken und Sparkassen auf das Konto des Deutschen Patent- und Markenamts der Tag der Einzahlung (in diesem Falle ist vom Einzahler jedoch darauf zu achten, dass ihm der Tag (Datum) der Einzahlung von dem Geldinstitut auf dem Einzahlungsbeleg, Durchschlag etc. hinreichend deutlich bestätigt wird);
  - d) im übrigen (insbesondere bei Überweisung) der Tag, an dem der Betrag bei der Zahlstelle des Deutschen Patent- und Markenamts eingeht oder auf dem umseitig genannten Konto gutgeschrieben wird.

## Gebrauchsmusterabzweigung

Der Anmelder einer nach dem 1. Januar 1987 mit Wirkung für die Bundesrepublik Deutschland eingereichten Patentanmeldung kann eine Gebrauchsmusteranmeldung, die den gleichen Gegenstand betrifft, einreichen und gleichzeitig den Anmeldetag der früheren Patentanmeldung in Anspruch nehmen. Diese Abzweigung (§ 5 Gebrauchsmustergesetz) ist bis zum Ablauf von 2 Monaten nach dem Ende des Monats möglich, in dem die Patentanmeldung durch rechtskräftige Zurückweisung, freiwillige Rücknahme oder Rücknahmefiktion erledigt, ein Einspruchsverfahren abgeschlossen oder - im Falle der Erteilung des Patents - die Frist für die Beschwerde gegen den Erteilungsbeschluss fruchtlos verstrichen ist. Ausführliche Informationen über die Erfordernisse einer Gebrauchsmusteranmeldung, einschließlich der Abzweigung, enthält das Merkblatt für Gebrauchsmusteranmelder (G 6181), welches kostenlos beim Deutschen Patent- und Markenamt und den Patentinformationszentren erhältlich ist.

### <sup>1</sup> Gebührencodes für Patentsachen:

| Gebühren-code | Gebühr bzw. Auslagen  | Gebühren-code | Gebühr bzw. Auslagen                      |
|---------------|---|---------------|---|
| 111 100       | Anmeldegebühr   | 112 107       | Patentjahresgebühr für das 7. Patentjahr  |
| 111 201       | Rechercheantragsgebühr  | 112 108       | Patentjahresgebühr für das 8. Patentjahr  |
| 102 010       | Auslagen für Abschriften aller ermittelten Druckschriften im Rechercheverfahren | 112 109       | Patentjahresgebühr für das 9. Patentjahr  |
| 111 301       | Prüfungsantragsgebühr, wenn ein Rechercheantrag gestellt worden ist             | 112 110       | Patentjahresgebühr für das 10. Patentjahr |
| 111 302       | Prüfungsantragsgebühr, wenn ein Rechercheantrag nicht gestellt worden ist       | 112 111       | Patentjahresgebühr für das 11. Patentjahr |
| 102 020       | Auslagen für Abschriften aller ermittelten Druckschriften im Prüfungsverfahren  | 112 112       | Patentjahresgebühr für das 12. Patentjahr |
| 111 500       | Erteilungsgebühr  | 112 113       | Patentjahresgebühr für das 13. Patentjahr |
| 112 103       | Patentjahresgebühr für das 3. Patentjahr  | 112 114       | Patentjahresgebühr für das 14. Patentjahr |
| 112 104       | Patentjahresgebühr für das 4. Patentjahr  | 112 115       | Patentjahresgebühr für das 15. Patentjahr |
| 112 105       | Patentjahresgebühr für das 5. Patentjahr  | 112 116       | Patentjahresgebühr für das 16. Patentjahr |
| 112 106       | Patentjahresgebühr für das 6. Patentjahr  | 112 117       | Patentjahresgebühr für das 17. Patentjahr |
|               |   | 112 118       | Patentjahresgebühr für das 18. Patentjahr |
|               |   | 112 119       | Patentjahresgebühr für das 19. Patentjahr |
|               |   | 112 120       | Patentjahresgebühr für das 20. Patentjahr |

Translation of the explanations of enclosure 2 of the search report of the European Patent Office ("Europäisches Patentamt") explaining the symbol letters stating the relevancy of the cited references:

### Explanations

Column 1: Category of Named Documents

- X: Reference which by itself is considered to have special significance
- Y: Reference which in combination with another reference in the same category is considered to have special significance
- A: Technological background
- O: Disclosure not in writing
- P: In-between literature
- T: Theories or principles basic to the invention
- E: Older patent document published on or after filing date
- D: Reference cited in the patent application
- L: Reference cited for other reasons
- &: Member of same patent family, corresponding document

Column 2: Identification of document, specifying the relevant portions, if necessary

Column 3: Concerned claims  
(In this column, the claims allocated to the relevant passages of column 2 are indicated.)

Column 4: Classification of Application (Int. Cl. 7)

Searched Fields (Int. Cl. 7)



P.B.5818 - Patentlaan 2  
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☎ +31 70 340 2040  
TX 31651 epo nl  
FAX +31 70 340 3016

**Europäisches  
Patentamt**

Zweigstelle  
in Den Haag  
Recherchen-  
abteilung

**European  
Patent Office**

Branch at  
The Hague  
Search  
division

**Office européen  
des brevets**

Département à  
La Haye  
Division de la  
recherche

Liebe, Rainer  
ALSTOM (Switzerland)Ltd  
CHSP Intellectual Property  
Haselstrasse 16/699/5.0G  
5401 Baden  
SUISSE

|               |         |         |  |
|---------------|---------|---------|--|
| CHSP          | Eingang | Ablage: |  |
| 16. APR. 2002 |         |         |  |
| SB            |         |         |  |
| Visa          |         |         |  |

Datum/Date  
16.04.02

|  |  |
|--|--|
| Zeichen/Ref./Réf.<br><b>99/190 EP</b>  | Anmeldung Nr./Application No./Demande n°/Patent Nr./Patent No./Brevet n°.<br><b>00810729.4-1526-</b> |
| Anmelder/Applicant/Demandeur/Patentinhaber/Proprietor/Titulaire<br><b>Alstom</b> |  |

## MITTEILUNG

Das Europäische Patentamt übermittelt beiliegend den europäischen Recherchenbericht zu der obengenannten europäischen Patentanmeldung.

Wenn zutreffend, Kopien der im Recherchenbericht aufgeführten Schriften sind beigelegt.

☒ Zusätzliche Kopie(n) der im europäischen Recherchenbericht angeführten Schriftstücke sind beigelegt.

Die folgenden Angaben des Anmelders wurden von der Recherchenabteilung genehmigt:

☒ Zusammenfassung

☒ Bezeichnung

☐ Die Zusammenfassung wurde von der Recherchenabteilung abgeändert und der endgültige Wortlaut ist dieser Mitteilung beigelegt.

Die folgende Abbildung wird mit der Zusammenfassung veröffentlicht:

3



## RÜCKERSTATTUNG DER RECHERCHEGEBÜHR

Falls Artikel 10 der Gebührenordnung in Anwendung kommt, ergeht noch eine gesonderte Mitteilung der Eingangsstelle hinsichtlich der Rückerstattung der Recherchegebühr.





Europäisches  
Patentamt

## EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung  
EP 00 81 0729

| EINSCHLÄGIGE DOKUMENTE  |  |   |   |
|---|--|---|---|
| Kategorie   | Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile  | Betrifft Anspruch   | KLASSIFIKATION DER ANMELDUNG (Int.Cl.7) |
| X   | DE 11 37 120 B (LICENTIA PATENT VERWALTUNGS GMBH)<br>27. September 1962 (1962-09-27)   | 1, 2  | H02K5/04<br>H02K1/18                    |
| A   | * Spalte 3; Abbildungen 1, 2 *   | 3   |   |
|   | ---  |   |   |
| D, A  | EP 0 633 643 A (ABB MANAGEMENT AG)<br>11. Januar 1995 (1995-01-11)<br>* Abbildung 1 *  | 1   |   |
|   | ---  |   |   |
| D, A  | US 4 663 553 A (ZIMMERMANN HANS)<br>5. Mai 1987 (1987-05-05)<br>* Abbildung 1 *  | 1   |   |
|   | ---  |   |   |
| A   | EP 0 320 252 A (NORTHERN ENG IND)<br>14. Juni 1989 (1989-06-14)<br>* Spalte 4, Zeile 52 - Zeile 54; Abbildung 1 *  | 1   |   |
|   | ---  |   |   |
| A   | PATENT ABSTRACTS OF JAPAN<br>vol. 010, no. 209 (E-421),<br>22. Juli 1986 (1986-07-22)<br>& JP 61 049629 A (TOSHIBA CORP),<br>11. März 1986 (1986-03-11)<br>* Zusammenfassung * | 1   |   |
|   | -----  |   |   |
| Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt   |  |   |   |
| Recherchenort<br><b>BERLIN</b>  |  | Abschlußdatum der Recherche<br><b>28. März 2002</b>   | Prüfer<br><b>Roy, C</b>                 |
| KATEGORIE DER GENANNTEN DOKUMENTE<br>X : von besonderer Bedeutung allein betrachtet<br>Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie<br>A : technologischer Hintergrund<br>O : nichtschriftliche Offenbarung<br>P : Zwischenliteratur |  | T : der Erfindung zugrunde liegende Theorien oder Grundsätze<br>E : älteres Patentedokument, das jedoch erst am oder nach dem Anmeldedatum veröffentlicht worden ist<br>D : in der Anmeldung angeführtes Dokument<br>L : aus anderen Gründen angeführtes Dokument<br>.....<br>& : Mitglied der gleichen Patentfamilie, übereinstimmendes Dokument |   |

1

EPO FORM 1503 03.82 (P04C03)

# ANHANG ZUM EUROPÄISCHEN RECHERCHENBERICHT ÜBER DIE EUROPÄISCHE PATENTANMELDUNG NR.

EP 00 81 0729

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten europäischen Recherchenbericht angeführten Patentdokumente angegeben.

Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am

Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

28-03-2002

| Im Recherchenbericht<br>angeführtes Patentdokument |   | Datum der<br>Veröffentlichung | Mitglied(er) der<br>Patentfamilie |               | Datum der<br>Veröffentlichung |
|--|---|-------------------------------|-----------------------------------|---------------|-------------------------------|
| DE 1137120   | B |                               | KEINE                             |               |                               |
| EP 0633643   | A | 11-01-1995                    | DE                                | 4322268 A1    | 12-01-1995                    |
|  |   |                               | AT                                | 148596 T      | 15-02-1997                    |
|  |   |                               | CN                                | 1098231 A , B | 01-02-1995                    |
|  |   |                               | CZ                                | 9401588 A3    | 18-01-1995                    |
|  |   |                               | DE                                | 59401690 D1   | 13-03-1997                    |
|  |   |                               | EP                                | 0633643 A2    | 11-01-1995                    |
|  |   |                               | ES                                | 2099997 T3    | 01-06-1997                    |
|  |   |                               | HR                                | 940355 A1     | 31-10-1996                    |
|  |   |                               | HU                                | 71082 A2      | 28-11-1995                    |
|  |   |                               | JP                                | 7075268 A     | 17-03-1995                    |
|  |   |                               | PL                                | 303748 A1     | 09-01-1995                    |
|  |   |                               | RU                                | 2119226 C1    | 20-09-1998                    |
|  |   |                               | US                                | 5442249 A     | 15-08-1995                    |
| US 4663553   | A | 05-05-1987                    | CH                                | 665507 A5     | 13-05-1988                    |
|  |   |                               | AT                                | 37255 T       | 15-09-1988                    |
|  |   |                               | BR                                | 8502743 A     | 12-02-1986                    |
|  |   |                               | DE                                | 3565033 D1    | 20-10-1988                    |
|  |   |                               | EP                                | 0166114 A1    | 02-01-1986                    |
|  |   |                               | ES                                | 544076 D0     | 16-07-1986                    |
|  |   |                               | ES                                | 8609839 A1    | 16-12-1986                    |
|  |   |                               | IN                                | 165105 A1     | 19-08-1989                    |
|  |   |                               | JP                                | 1796420 C     | 28-10-1993                    |
|  |   |                               | JP                                | 5003215 B     | 14-01-1993                    |
|  |   |                               | JP                                | 61004428 A    | 10-01-1986                    |
|  |   |                               | KR                                | 9107672 B1    | 30-09-1991                    |
|  |   |                               | PL                                | 253888 A1     | 08-04-1986                    |
|  |   |                               | SU                                | 1412604 A3    | 23-07-1988                    |
| EP 0320252   | A | 14-06-1989                    | AT                                | 100979 T      | 15-02-1994                    |
|  |   |                               | DE                                | 3887481 D1    | 10-03-1994                    |
|  |   |                               | DE                                | 3887481 T2    | 23-06-1994                    |
|  |   |                               | EP                                | 0320252 A2    | 14-06-1989                    |
|  |   |                               | ES                                | 2051866 T3    | 01-07-1994                    |
|  |   |                               | JP                                | 1295637 A     | 29-11-1989                    |
|  |   |                               | JP                                | 2739111 B2    | 08-04-1998                    |
|  |   |                               | US                                | 4894573 A     | 16-01-1990                    |
| JP 61049629  | A | 11-03-1986                    | JP                                | 1664985 C     | 19-05-1992                    |
|  |   |                               | JP                                | 3028903 B     | 22-04-1991                    |

EPO FORM P0461

## HORIZONTAL-AXIS ELECTRICAL MACHINE

The present invention relates to the field of electrical machines. It concerns a horizontal-axis electrical machine according to the preamble of claim 1.

Such a machine is known, for example, from the applicant's EP-A2-0 633 643.

In the case of gas-cooled electrical machines, such as turbogenerators for example, the operationally related heating causes great axial and radial expansions to occur in the laminated stator core, in particular in relatively high output ranges, and these expansions have to be transferred as uniformly as possible to the casing surrounding the laminated stator core. It has already been proposed in this respect in US-A-4,663,553 to wedge the laminated stator core in a multiplicity of bearing rings which are perpendicular to the longitudinal axis of the machine, spaced apart from one another and securely welded on opposite sides to the bottom casing section by means of vertical fastening plates and horizontal pieces of tube. This type of fastening allows simple assembly and easy accessibility of the structural parts to be welded and, furthermore, ensures good quality of the welds.

However, it has been found that, in the case of large machines, vibrational isolation between the laminated stator core and the casing would be desirable in order to reduce noise emissions and reliably avoid excessive mechanical stresses of the connecting points between the laminated stator core and the bottom casing section. Such isolation is achieved according to the initially cited EP-A2-0 633 643 in a simple and cost-effective way by the fastening plates arranged between the bearing rings and the bottom casing section being connected to the bearing rings and the bottom casing section in such a way that they act as leaf springs. Such a resilient suspension of the laminated stator core in the casing is reproduced in Figure 1. Figure 1

shows in a simplified half-side cross section a horizontal-axis electrical machine 10, which comprises concentrically in relation to a longitudinal axis 36 of the machine a rotor 12 and a laminated stator core 11 surrounding the rotor 12. The rotor 12 and the laminated stator core 11 are accommodated in a casing 14, which is subdivided along a horizontal center plane 23 into a bottom casing section 15 and a top casing section 16. The top casing section 16 can be removed from the bottom casing section 15 for assembly and/or maintenance purposes.

The laminated stator core 11 is - as already described in US-A-4,663,553 or in EP-A2-0 633 643 - fastened in a wedged manner in a multiplicity of bearing rings 13 (13, 13', 13'' in Figure 2) arranged one behind the other in the longitudinal axis 36 of the machine. The bearing rings 13 have widenings 22, which protrude laterally on opposite sides and at which they are resiliently connected to the bottom casing section 15. For this purpose, at the upper and lower ends of each widening 22 there are respectively welded on laterally projecting fastening blocks 20, 21, at which for their part a fastening plate 19 acting as a leaf spring is externally welded onto the ends. The fastening plate 19 is welded in its middle region via a plurality of pieces of tube 18, arranged one above the other, to a vertical, planar casing portion 17 of the bottom casing section 15. This type of fastening is represented in Figure 2 in longitudinal section along the plane A-A from Figure 1.

Since the laminated stator core 11 has in comparison with the casing 14 a comparatively large mass, considerable acceleration forces can occur between the laminated stator core 11 and the casing 14 during transportation of the machine 10 from its place of production to the place of use, subjecting the resilient fastening and, in particular, the welds provided there to high mechanical stresses. To avoid stresses of this kind during transportation, or at

least reduce them to a harmless level, so-called transport arresting screwed joints 28, 29 are used - as shown in Figure 2. These transport arresting screwed joints are essentially adjustable supporting elements which support the bearing rings 13', 13'' against neighboring casing ribs 24, 25 and 26, 27, respectively, of the bottom casing section 15 during transportation. For this purpose, threaded sleeves, into which corresponding screws are screwed at the free end, are welded on parallel to the principal axis 36 of the machine on both sides of the bearing ring. When the laminated stator core 11 is inserted into the bottom casing section 15 during pre-assembly at the factory, the screws are initially screwed into the threaded sleeves sufficiently far not to be in the way. Once the bearing rings 13, 13' and 13'' have been welded to the bottom casing section 15, the screws of the transport arresting screwed joints 28, 29 are unscrewed until they butt with the upper side of the screw head against the neighboring casing rib, as represented in Figure 2. The laminated stator core 11 is then securely braced in the bottom casing section 15. When there is an axial acceleration of the laminated stator core 11 in relation to the casing 14 during transportation, the acceleration forces occurring can thus be introduced reliably into the casing ribs 24,..., 27, without exerting any load on the resilient suspension.

However, it is disadvantageous here that, after the machine 10 has been set up and before it is put into operation, the transport arresting screwed joints have to be unscrewed or loosened, so that a clearance of, for example, 20 mm is created between the screws and the casing ribs 24,..., 27 in order that the laminated stator core 11 can freely expand in relation to the housing when the operationally related heating occurs. This is of no consequence if the machine is sent to the place where it is to be set up without a top casing section 16 and with a special transport

cover, because unscrewing of the transport arresting  
screwed joints before fitting of the top casing section  
16 is possible without any great additional effort.  
If, on the other hand, the machine 10 is sent in the  
5 complete casing 14 without a transport cover, the top  
casing section 16 first has to be disassembled at the  
place of use in the plant in order to loosen the  
transport arresting screwed joints. This is followed  
by re-fitting of the top casing section. This  
10 procedure is cost-intensive and time-consuming.

It is therefore the object of the invention to  
provide a machine of the type stated at the beginning  
in which secure transportation is ensured with regard  
to the acceleration forces and their effects on the  
15 resilient mounting of the laminated stator core,  
without any transport securing means having to be  
unscrewed at the place where the machine is set up.

The object is achieved by the overall  
combination of features of claim 1. The essence of the  
20 invention is to limit the relative movement between the  
laminated stator core and the bottom casing section by  
suitable means in such a way that, on the one hand,  
excessive movements or acceleration forces are absorbed  
during transportation and, on the other hand, the  
25 operationally related thermal expansions of the  
laminated stator core are not hindered.

A first preferred embodiment of the machine  
according to the invention is characterized in that the  
casing ribs run parallel to the bearing rings, in that  
30 the securing means are respectively arranged between a  
bearing ring and a neighboring casing rib, and in that  
the securing means are designed as spacers which extend  
between the respective bearing ring and the neighboring  
casing rib, and which are connected by one end securely  
35 to the bearing ring or the neighboring casing rib and  
have a clearance between the other end and the  
neighboring casing rib or the bearing ring. A suitably  
chosen clearance can allow the movement during

transportation to be effectively limited, without hindering the thermal expansion during later operation.

It is particularly simple if the spacers are designed such that they are adjustable in their length, because then the spacers can be adapted flexibly to the various applications during their fitting. The spacers preferably comprise in each case a threaded sleeve and a screw screwed into the threaded sleeve.

Allowance can be made for the thermal expansion during operation, increasing toward the outer ends of the laminated stator core, by providing that - if the laminated stator core extends on both sides of a vertical center plane oriented perpendicular to the longitudinal axis of the machine - the spacers for the bearing rings further away from the vertical center plane are respectively arranged only between the bearing ring and the neighboring casing rib lying closer to the vertical center plane, while the spacers for the bearing rings lying closer to the vertical center plane are respectively arranged between the bearing ring and the two neighboring casing ribs.

Further embodiments emerge from the dependent claims.

The invention is to be explained in more detail below on the basis of exemplary embodiments in conjunction with the drawing, in which:

Figure 1 shows in a simplified half-side cross section a horizontal-axis electrical machine with resilient fastening of the laminated stator core in the casing, as to be considered for the implementation of the invention;

Figure 2 shows in a simplified longitudinal section in the plane A-A from Figure 1 the machine according to Figure 1 with a transport arresting screwed joint used until now; and

Figure 3 shows a representation comparable with Figure 2, with transport securing means according to a preferred exemplary embodiment of the invention.

The invention, as represented in Figure 3 by way of example, now uses instead of the previous transport arresting screwed joints, which have to be tightened for transportation and subsequently laboriously loosened again, fixedly adjusted spacers 31..., 33. Although the spacers 31..., 33 are of a structurally identical design to the transport arresting screwed joints 28, 29 of Figure 2, they differ significantly with respect to arrangement and function. The spacers 31..., 33 in each case comprise threaded sleeves 34, which are welded at one end to one of the bearing rings 13, 13' and 13'', and screws 35, which are screwed into the free end of the threaded sleeves 34 and then fixed.

The spacers 31..., 33 are respectively attached to the edge of the horizontal widening 22 of the bearing rings 13..., 13'' such that they lie in the horizontal center plane 23. The screws 35 are all screwed into the threaded sleeves 34 to the extent that there is a clearance SP of just a few millimeters between the upper sides of the screw heads and the adjacent casing rib 30 or 25..., 27. This clearance SP remains unchanged during and after the transportation of the machine 10 and only changes when the laminated stator core thermally expands during operation.

Since, during the operationally related thermal expansion of the laminated stator core 11, the relative movement between the laminated stator core 11 and the bottom casing section 15 is all the greater the further the location on the laminated stator core 11 is away from the vertical center plane 37, and in the vertical center plane 37 itself tends toward zero, the design and arrangement of the spacers 31..., 33 change with the distance from the vertical center plane 37 of the laminated stator core 11. For the bearing rings 13, 13' further away from the vertical center plane 37, the spacers 31, 32 are respectively arranged only on one side between the bearing ring and the neighboring casing rib 30 or 25 lying closer to the vertical center



plane 37. On the right-hand side (not represented in Figure 3) of the vertical center plane 37, the arrangement is correspondingly mirror-inverted.

In this way, the transportationally related  
5 relative movement, which is uniform for the entire laminated stator core 11, can be reliably limited in both possible axial directions. If the laminated stator core 11 moves to the left in Figure 3, the outer  
10 spacers to the right of the center plane 37 limit the movement. If, on the other hand, the laminated stator core 11 moves to the right, the outer spacers 31, 32 to the left of the center plane 37 limit the movement. The operationally related thermal relative movement, which is directed outward in opposite directions on  
15 both sides of the center plane 37, on the other hand, is not hindered by the outer spacers 31, 32, because their clearance increases. For the bearing rings 13'' lying closer to the vertical center plane 37, for which the thermally related relative movement is likely to be  
20 small, the spacers 33 may be respectively arranged in opposite directions between the bearing ring and the two neighboring casing ribs 26, 27. During operation, the clearance SP between the spacer 33 and the casing ribs 26, 27 then increases on the right-hand side of  
25 the bearing ring 13'', while it decreases on the left-hand side, without however becoming zero.

Altogether, acceleration forces of up to 1 g can be reliably absorbed and dissipated in this way without changing the spacers 31,..., 33 during  
30 transportation of the machine 10, while during later operation the laminated stator core 11, being warmer than the casing 14, can freely expand.

LIST OF DESIGNATIONS

|                |                                      |
|----------------|--------------------------------------|
| 10             | electrical machine (horizontal-axis) |
| 11             | laminated stator core                |
| 12             | rotor                                |
| 13, 13', 13''  | bearing ring                         |
| 14             | casing                               |
| 15             | bottom casing section                |
| 16             | top casing section                   |
| 17             | casing portion (vertical, planar)    |
| 18             | piece of tube                        |
| 19             | fastening plate                      |
| 20,21          | fastening block                      |
| 22             | widening (horizontal)                |
| 23             | center plane (horizontal)            |
| 24,..., 27, 30 | casing rib                           |
| 28,29          | transport arresting screwed joints   |
| 31,..., 33     | spacers                              |
| 34             | threaded sleeve                      |
| 35             | screw                                |
| 36             | longitudinal axis of machine         |
| 37             | center plane (vertical)              |
| SP             | clearance                            |

PATENT CLAIMS

1. A horizontal-axis electrical machine (10),  
comprising a casing (14, 15, 16), which is reinforced  
5 by casing ribs (24,..., 27, 30) and is subdivided into a  
bottom casing section (15) and a removable top casing  
section (16), and comprising a laminated stator core  
(11), which is braced in bearing rings (13, 13', 13''),  
which are arranged perpendicular to the longitudinal  
10 axis (36) of the machine, are spaced apart from one  
another and are resiliently connected at a plurality of  
points of their outer circumference to the bottom  
casing section (15) by means of fastening parts (18,  
19, 20, 21), characterized in that between the  
15 laminated stator core (11) or the bearing rings (13,  
13', 13'') and the bottom casing section (15) there are  
arranged fixedly adjusted securing means (31,..., 35),  
which during transportation of the machine (10) limit  
the axial relative movement between the laminated  
20 stator core (11) or the bearing rings (13, 13', 13'')  
and the bottom casing section (15), and during  
operation ensure a free expansion of the warmer  
laminated stator core (11) with respect to the colder  
casing (14, 15, 16).

25 2. The machine as claimed in claim 1,  
characterized in that the casing ribs (24,..., 27, 30)  
run parallel to the bearing rings (13, 13', 13''), and  
in that the securing means (31,..., 35) are respectively  
arranged between a bearing ring (13, 13', 13'') and a  
30 neighboring casing rib (24,..., 27, 30).

3. The machine as claimed in claim 2,  
characterized in that the securing means are designed  
as spacers (31,..., 33) which extend between the  
respective bearing ring and the neighbouring casing  
35 rib, and which are connected by one end securely to the  
bearing ring or the neighboring casing rib and have a  
clearance (SP) between the other end and the  
neighboring casing rib or the bearing ring.

4. The machine as claimed in claim 3, characterized in that the spacers (31,..., 33) are designed such that they are adjustable in their length.

5. The machine as claimed in claim 4,  
5 characterized in that the spacers (31,..., 33) comprise in each case a threaded sleeve (34) and a screw (35) screwed into the threaded sleeve (34).

6. The machine as claimed in one of claims 3 to 5,  
10 characterized in that the laminated stator core (11) extends on both sides of a vertical center plane (37) oriented perpendicular to the longitudinal axis (36) of the machine, and in that the spacers (31, 32) for the bearing rings (13, 13') further away from the vertical center plane (37) are respectively arranged only  
15 between the bearing ring and the neighboring casing rib (30 or 25) lying closer to the vertical center plane (37).

7. The machine as claimed in claim 6,  
20 characterized in that the spacers (33) for the bearing rings (13'') lying closer to the vertical center plane (37) are respectively arranged between the bearing ring and the two neighboring casing ribs (26, 27).

8. The machine as claimed in one of claims 1 to 7,  
25 characterized in that the fastening parts comprise elongate fastening plates (19) which act as leaf springs, are vertically arranged and are securely connected, in particular welded, in each case in the middle region to the bottom casing section (15) and at the ends to the bearing rings (13, 13', 13'').

## ABSTRACT

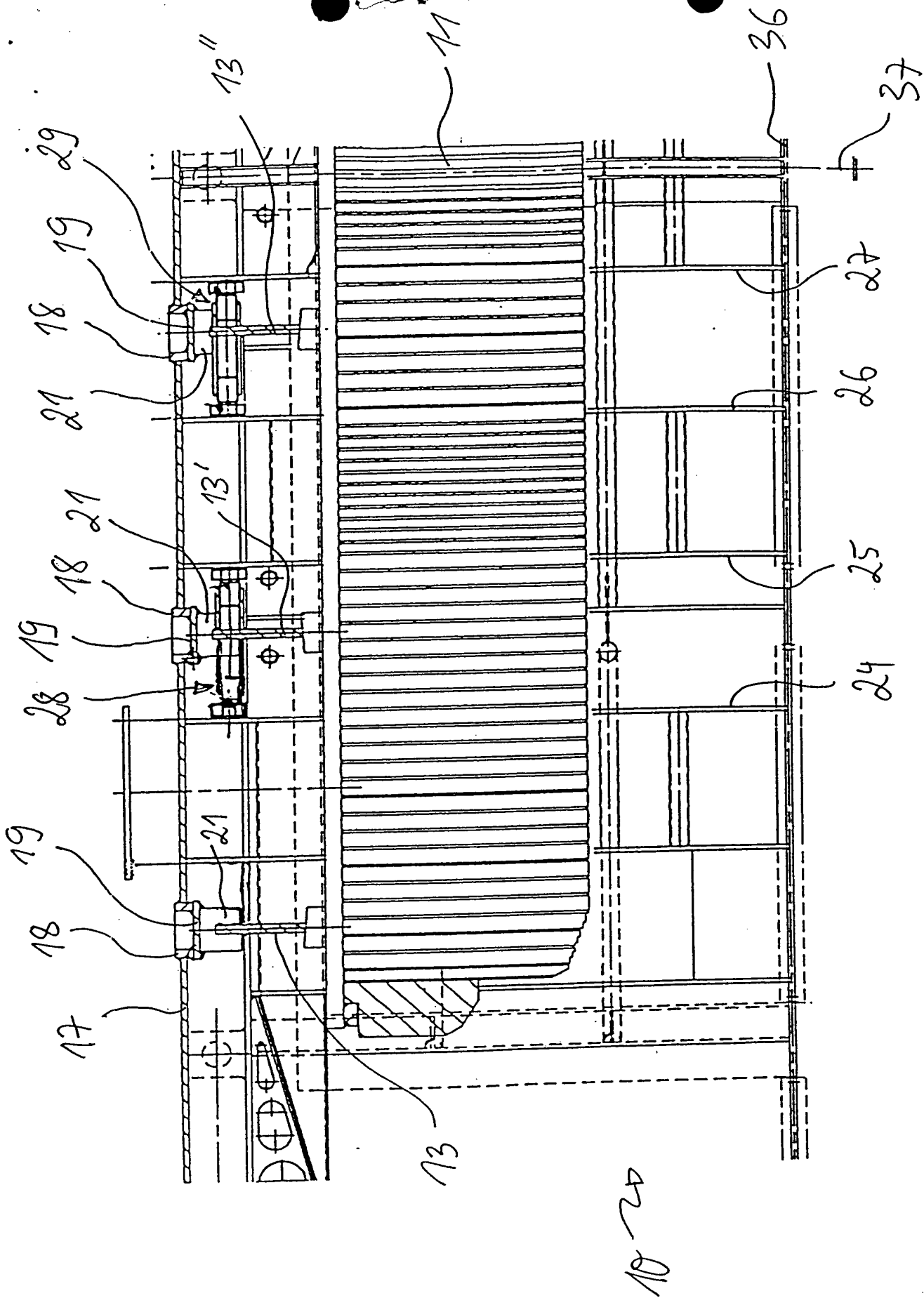
A horizontal-axis electrical machine (10) comprises a casing (14, 15, 16), which is reinforced by casing ribs (24,..., 27, 30) and is subdivided into a bottom casing section (15) and a removable top casing section (16), and comprises a laminated stator core (11), which is braced in bearing rings (13, 13', 13''), which are arranged perpendicular to the longitudinal axis (36) of the machine and are spaced apart from one another, the bearing rings (13, 13', 13'') being resiliently connected at a plurality of points of their outer circumference to the bottom casing section (15) by means of fastening parts (18, 19, 20, 21).

In the case of such a machine (10), transport securement that does not hinder later operation is achieved by providing that between the laminated stator core (11) or the bearing rings (13, 13', 13'') and the bottom casing section (15) there are arranged fixedly adjusted securing means (31,..., 35), which during transportation of the machine (10) limit the axial relative movement between the laminated stator core (11) or the bearing rings (13, 13', 13'') and the bottom casing section (15), and during operation ensure a free expansion of the warmer laminated stator core (11) with respect to the colder casing (14, 15, 16).

(Figure 3)



Fig. 1



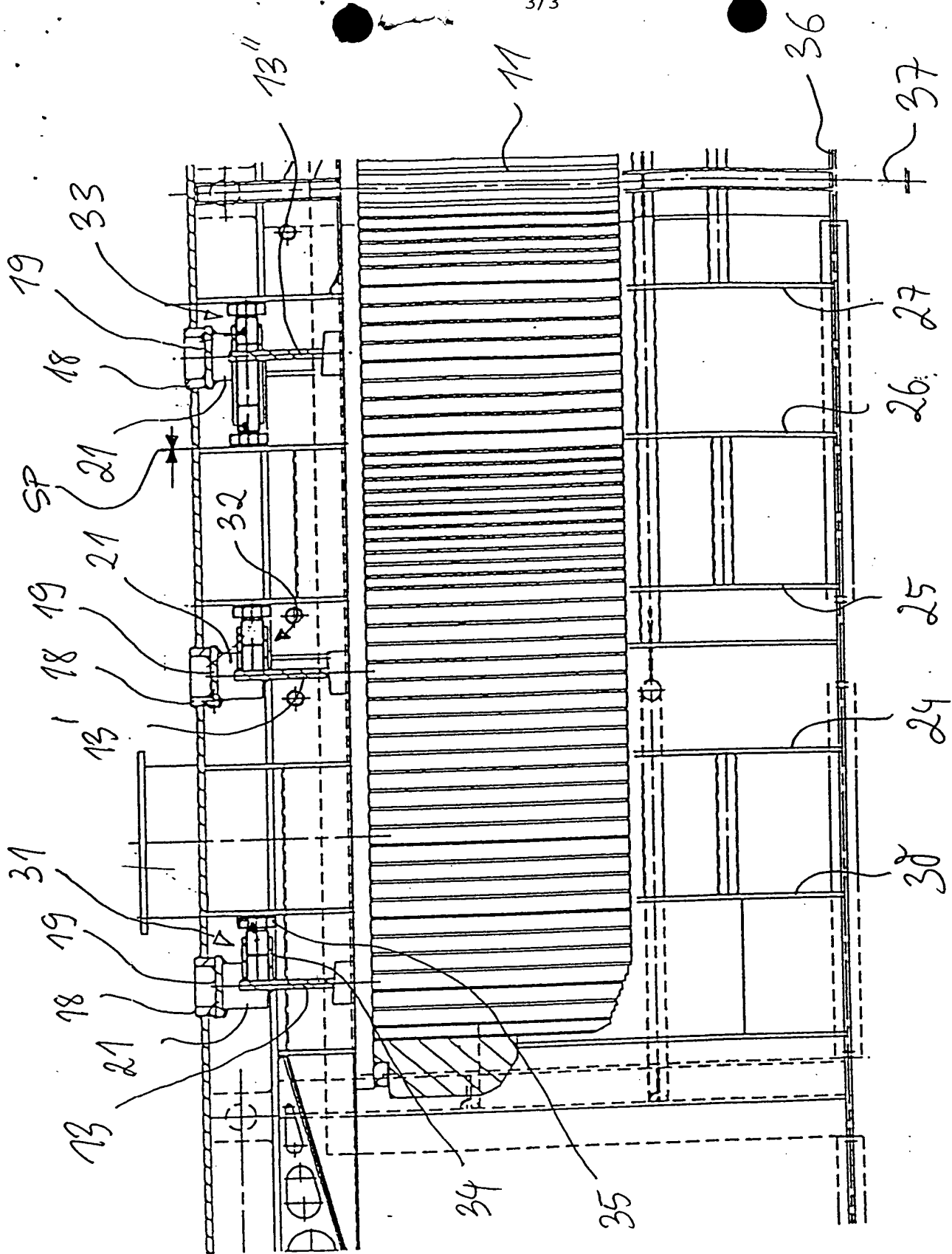


Fig. 3